URS

April 26, 2012

Mr. Nathan Dadap
United States Environmental Protection Agency Region IX
RCRA Facilities Management (WST-4)
75 Hawthorne Street
San Francisco, California 94105

Re: Amendment #7 to the November 18, 2011 Application and Soil Management Plan
Risk Receptor Revisions
Birch Hills Golf Course
2250 East Birch Street, Brea, California

Dear Mr. Dadap:

On behalf of Chevron Land and Development Company (Chevron), URS Corporation (URS) is submitting Amendment #7 to the November 18, 2011 Application and Soil Management Plan for the poly-chlorinated biphenyls (PCBs) detected on the Birch Hills Golf Course located in Brea, California (Site). This amendment is being submitted to Region IX of the United States Environmental Protection Agency (EPA) in accordance with 40 Code of Federal Regulations (CFR) Part 761.61(c) and to the Orange County Health Care Agency, which provides oversight for remedial activities at the Golf Course.

Amendment #7 replaces Section 2.1, "Soil Screening Criteria" and Appendix G, "Preliminary Risk Screening Criteria Development for PCBs" from the November 18, 2011 Soil Management Plan. The main change in Section 2.1 (see attached replacement Section 2.1) is the modification of the summary table to include additional risk-based receptors (adult golfer, child golfer, and teen trespasser) requested by the EPA, and alternate scenarios for the construction worker and maintenance worker scenarios, to supplement the original construction and maintenance worker receptors. A copy of the revised table is shown below. Appendix G text and tables have also been changed in response to comments from the EPA and OCHCA (see attached replacement Appendix G), including details on the development of the risk-based screening levels for the additional and alternate receptors.

Site Specific Risk-Based Soil Screening Criteria for Comparison to Statistically Averaged Site Data
Birch Hills Golf Course, Brea, California
April 2012

Analytes	RSL		Site-Specific Risk-Based						
	Residential (mg/kg)	Commercial (mg/kg)	Construction Worker (primary) (mg/kg)	Construction Worker (Alternate) (mg/kg)	Maintenance Worker (primary) (mg/kg)	Maintenance Worker (alternate) (mg/kg)	Adult Golfer (mg/kg)	Child Golfer (mg/kg)	Teenager Trespasser (mg/kg)
Exposure Unit	Planning Areas 12A and 12B	Existing Golf Course Clubhose/ Potential Community Center	Entire Site	Southern Area Only	Entire Site	Southern Area Only	Entire Site - Playing 18 Holes	Entire Site - Playing 18 Holes	Southern Area Only
PCBs (Aroclor 1254 and Aroclor 1260)	0.220	0.740	4.0	2.0	40	20	6.1	7.1	19
Notes:									
RSL = EPA Region IX Regional Screening Levels, June 2011 version									
Risk-based = Site-specific values (Appendix G). Value presented is the lower of the carcinogenic or noncarinogenic values.									
Exposure Unit based on current golf course development plans and will be subject to change based on changes in future land use									

URS Corporation
2020 East First Street, Suite 400
Santa Ana, CA 92705-4032
Tel: 714.835.6886
Fax: 714.667.7147
www.urscorp.com

Changes to the criteria listed above were made based on EPA comments received electronically on April 5, 2012. Responses to the comments are summarized below:

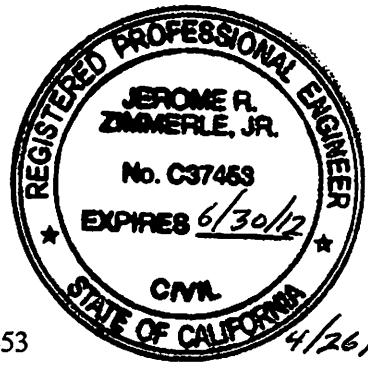
- The risk-based screening levels (RBSLs) include all pathways, including inhalation;
- Summary table has been modified to show the exposure units for each RBSL;
- RBSLs now include a non-cancer inhalation factor based on the ingestion reference dose;
- ADAF use has been removed;
- Particle emission factors are now set at the EPA recommended value of 1.36×10^{-9} m^3/kilogram;
- Dermal adherence factors were set at 0.2 milligrams per square centimeter (mg/cm^2) for the maintenance worker and a higher 0.8 mg/cm^2 value for the construction worker. However, for the adult golfer, we used an EPA derived value of 0.08 mg/cm^2 for outdoor sports on a grass field (soccer) as a more appropriate approach given that a golfer would not be performing the same heavy soil contact activities as a construction worker or a maintenance worker in a trench (see attached Appendix G for reference). The same EPA reference provided a 0.3 mg/cm^2 value for a child/teenager involved in outdoor sports (soccer), so this more health-protective value was used for these younger receptors;
- Averaging time for non-carcinogenic analysis of the construction worker receptor has been set to 365 days per year;
- Given that the standard use of the golf course exposure unit by golfer receptors would involve activities equally spent on both the northern and southern halves of the golf course, the fraction of contaminated soil was estimated to be 50% for ingestion and dermal exposures to reflect that the southern half of the site has PCB impacts and the northern half of the site has no to limited PCB impacts. Inhalation exposures reflect a similar halving of the duration of the golf round from 5 hours to 2.5 hours spent on the impacted half of the golf course. The adjusted fraction of contaminated soil was not used for the teenage trespasser (defined as spending time on the golf course lake in the southern half of the site) and for an alternate construction worker receptor involved in construction activity on the southern half of the golf course only;
- The alternate maintenance worker receptor is similarly exposed to the southern half of the golf course (half the workday); however, daily maintenance activities where soil exposure might occur (trenching for water line replacement/repair and/or sprinkler repair) were set at 5% of the day versus activities that do not involve soil exposure (lawn mowing, landscape maintenance, etc.) based on discussions with the former golf course operations manager on the percentage of time spent on direct soil exposure activities as noted in the November 18, 2011 Soil Management Plan;
- Soil ingestion rates were modified to reflect the EPA recommended values of 100 milligrams per day (mg/day)(adult golfer) and 200 mg/day (child golfer and teenage trespasser). However, these receptors spend limited time at the golf course each day, so the recommended daily rate values were adjusted as follows:
    - Adult and child golfers are only at the golf course for 5 hours per day, so the ingestion rate was pro-rated using 5 hours out of 18 waking hours per day;

  - Teenage trespasser is only at the golf course for 4 hours per day, so the ingestion rate was pro-rated using 4 hours out of 18 waking hours per day.
- Exposure frequency for the adult and child golfers and teenage trespasser receptors was determined to be less than the longer term frequency (250 days) applied to site workers who would be at the golf course more consistently. Specifically, the details for each of these non-worker receptors are provided as follows:
  - Adult and child golfers – 2 days per week for 50 weeks per year for a total of 100 rounds of golf per year reflects an avid golfing receptor over the 30 year and 8 year exposure durations for each receptor, respectively.
  - Teenage trespasser – 2 days per week for 20 weeks during the spring/summer months over a 4 year period from ages 14 to 17. The basis of this scenario is a receptor illegally entering the golf course, during the middle of the night when the golf course is closed, to spend time at the golf course lake without being noticed by the residences immediately adjacent to the west and east of the golf course/golf course lake. A limited exposure frequency reflecting time periods when a teenage receptor has additional free time (spring/summer breaks) and during warmer months when outdoor activity near a lake would be expected, is an appropriate approach to this receptor.
- Exposure time for the maintenance worker was adjusted to 0.4 hours per 8-hour workday to reflect activities that involve soil exposure (trenching for water line replacement/repair and/or sprinkler repair) versus activities that do not involve soil exposure (lawn mowing, landscape maintenance, etc.) based on discussions with the former golf course operations manager on the percentage of time spent on direct soil exposure activities (5 percent) as noted in the November 18, 2011 Soil Management Plan.

Revised tables showing exposure parameters and exposure route results, and the detailed calculation spreadsheets are provided as attachments to the attached Appendix G.

If you have any questions/comments please feel free to contact Jim Martinez at (714) 319-2257 or Jerome Zimmerle at (714) 433-7738.

Sincerely,
URS Corporation



Jerome R. Zimmerle Jr., PE
Principal Engineer
California Professional Engineer No. C37453

4/26/12

cc: Jim Martinez (Chevron), Trevor Black (Chevron), Garrick Jauregui (Chevron), Steve Speer (OCHCA), Carmen Santos (EPA)

SECTION 2.1

SOIL SCREENING CRITERIA

Section 2.1 Soil Screening Criteria

The following tables provide human health screening criteria based on soil exposure to future site residents, site construction and maintenance workers, alternate scenarios for construction and maintenance workers, adult and children golfers, and a teenager trespasser.

Soil Screening Criteria
Birch Hills Golf Course, Brea, California
April 2012

Analytes	RSL		CHHSL		Hazardous Waste		Groundwater Protection	Background
	Residential	Commercial	Residential	Commercial	Total	Leachable		
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)
PCBs (Aroclor 1254 and Aroclor 1260)	0.220	0.740	0.089	0.300	50	5.0	–	NA
Arsenic	0.39	1.6	0.07	0.24	500	5.0	–	11
Nitrate	130,000	1,600,000	NA	NA	NA	NA	1,800	NA
Dioxins/Furans	4.50E-06	1.80E-05	4.60E-06	1.90E-05	0.001	0.01	–	4.0
Notes:								
RSL = EPA Region IX Regional Screening Levels, June 2011 version								
CHHSL = California Human Health Screening Levels, January 2005								
Hazardous Waste = values per the State of California, Title 22								
Groundwater Protection = Calculated in Section 1.4.5.3 for nitrates. Values as discussed with Santa Ana Regional Water Quality Control Board								
Background = based on data in Bradford, 1996 consistent with values in surrounding area and in discussions with Orange County Health Care Agency								
Dioxins/Furans = value represented as the equivalent concentration of 2,3,7,8-TCDD								
NA = not available, not applicable or not calculated								

Site Specific Risk-Based Soil Screening Criteria for Comparison to Statistically Averaged Site Data
Birch Hills Golf Course, Brea, California
April 2012

Analytes	RSL		Site-Specific Risk-Based						
	Residential	Commercial	Construction Worker (primary)	Construction Worker (Alternate)	Maintenance Worker (primary)	Maintenance Worker (alternate)	Adult Golfer	Child Golfer	Teenager Trespasser
	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Exposure Unit	Planning Areas 12A and 12B	Existing Golf Course Clubhose/ Potential Community Center	Entire Site	Southern Area Only	Entire Site	Southern Area Only	Entire Site - Playing 18 Holes	Entire Site - Playing 18 Holes	Southern Area Only
PCBs (Aroclor 1254 and Aroclor 1260)	0.220	0.740	4.0	2.0	40	20	6.1	7.1	19
Notes:									
RSL = EPA Region IX Regional Screening Levels, June 2011 version									
Risk-based = Site-specific values (Appendix G). Value presented is the lower of the carcinogenic or noncarinogenic values.									
Exposure Unit based on current golf course development plans and will be subject to change based on changes in future land use									

References for the criteria are provided in the notes section below the tables. The process used to calculate the risk-based values is provided in Appendix G. If additional analytes are detected at elevated concentrations then the same references will be used with regulatory concurrence to identify additional screening criteria. Achievement of these criteria will also provide sufficient protection for environmental and ecological factors as noted in Section 1.3.5 of the November 18, 2011 URS Soil Management Plan.

With respect to selection of a screening criterion for arsenic, naturally-occurring arsenic concentrations normally exceed published threshold values such as the CHHSL (0.07 milligrams per kilogram [mg/kg]) or the RSL (0.39 mg/kg) (see table above). However, these standards are not intended to regulate naturally-occurring arsenic in soil, so regulatory agencies typically require that soil be cleaned up to levels consistent

with background concentrations. For this site, the background level for arsenic is 11 mg/kg as discussed with OCHCA, a value considered to be within the range of naturally-occurring background levels for California soils (Bradford, 1996).

APPENDIX G

PRELIMINARY RISK SCREENING

CRITERIA DEVELOPMENT FOR PCBS

APPENDIX G

PRELIMINARY RISK SCREENING

CRITERIA DEVELOPMENT FOR PCBS

Background

Aroclor 1254 and Aroclor 1260 have been detected in soil on the southern half of the Brea golf course located at 2250 E. Birch Street, Brea, California (Site). Golf course restoration combined with redevelopment activities including converting portions of the golf course to residential and community center use are planned for the Site. As a result, health-protective screening concentrations for Aroclor 1254 and Aroclor 1260 in soil were derived using exposure scenarios for an alternative construction worker scenario (Table G-1), an alternative golf course maintenance worker scenario (Table G-2), adult golfers (Table G-3), child golfers (Table G-4), and a teenage trespasser (Table G-5). Two screening values each were prepared for construction and maintenance workers to reflect work performed on either the entire course (primary) or the southern half of the golf course (alternate). Screening values have been adjusted to account for receptor activities that would occur on both the southern and northern halves of the golf course as the northern half of the golf course has only a limited number of Aroclor 1254 or Aroclor 1260 detections in soil (0.27 mg/kg maximum, which is below the commercial Regional Screening Levels [RSLs] and California Human Health Screening Levels [CHHSLs]).

Screening values for future residents and commercial workers who might have longer term durations at the Site, but less direct soil exposure will be based on default values (RSLs and CHHSLs).

The following risk analysis discusses development of the screening values for Aroclor 1254 as the more frequently detected, higher concentration PCB compound detected at the Site. These screening values would also apply to Aroclor 1260 as the carcinogenic toxicity values for both PCBs are the same.

Risk Analysis

The noncancer health hazards and incremental cancer risks were estimated for ingestion, dermal, and inhalation exposures for each receptor to Aroclor 1254 in soil based on an assumed unit concentration in soil that was set at 1 milligram of Aroclor 1254 per kilogram of soil (mg/kg) to develop an initial assessment. The hazard and risk estimates and the estimated soil exposure concentrations were then re-scaled to estimate a soil concentration that would achieve a health-protective target level for each receptor.

Ingestion, dermal, and inhalation exposure estimates were calculated according to U.S. Environmental Protection Agency (USEPA) guidance (USEPA, 1989 and 2009). Values for exposure parameters in the calculations were based on U.S. Environmental Protection Agency (USEPA) guidance for a construction worker receptor (USEPA, 1989 and 2009) with adjustment to account for the more temperate climate in

California by using California Department of Toxic Substances Control (DTSC) recommended default exposure factors for exposed skin surface and similar factors (DTSC, 2011a) as noted in Tables G-1 through G-5. An alternate construction worker receptor is assumed to have high contact with soil, but over a relatively shorter time frame (compared to residential or commercial/industrial worker scenarios). Exposure parameters for the alternate maintenance worker receptor were the same as those for construction workers, except for the exposure duration (25 years instead of 1 year for construction workers), more limited skin adherence with soil as grounds keepers (0.2 milligrams per cubic centimeter instead of 0.8 milligrams per cubic centimeter for construction workers), inhalation exposure time=0.4 hours per day, and 0.025 proportional exposure to contaminated soil via ingestion or skin contact. The reduced exposure time and exposure to contaminated soil were based on site-specific activity patterns reported by the former field supervisor at the golf course, who estimated that site maintenance workers spent approximately 5 percent of their time over a year working on sprinkler repair/replacement involving trenching/potholes and the rest of the time on golf course activities that do not involve direct soil handling, such as lawn mowing, above-ground landscape maintenance, above-ground sprinkler maintenance, above-ground construction, general golf course operations and maintenance, and similar tasks (Maldonado, 2011).

The site-specific receptors (alternate construction worker, alternate maintenance worker, adult golfer, child golfer, and teenage trespasser) employ exposure-factor modifications to account for site-specific exposure on the golf course, as well as including agency-recommended changes. These modifications include:

- Particle emission factors are now set at the EPA recommended value of 1.36×10^{-9} m^3/kilogram;
- Dermal adherence factors were set at 0.2 milligrams per square centimeter (mg/cm^2) for the maintenance worker and a higher 0.8 mg/cm^2 value for the construction worker. However, for the adult golfer, we used an EPA derived value of 0.08 mg/cm^2 for outdoor sports on a grass field (soccer) as a more appropriate approach given that a golfer would not be performing the same heavy soil contact activities as a construction worker or a maintenance worker in a trench (see attached Appendix G for reference). The same EPA reference provided a 0.3 mg/cm^2 value for a child/teenager involved in outdoor sports (soccer), so this more health-protective value was used for these younger receptors;
- Averaging time for non-carcinogenic analysis of the construction worker receptor has been set to 365 days per year;
- Given that the standard use of the golf course exposure unit by golfer receptors would involve activities equally spent on both the northern and southern halves of the golf course, the fraction of contaminated soil was estimated to be 50% for ingestion and dermal exposures to reflect that the southern half of the site has PCB impacts and the northern half of the site has no to limited PCB impacts. Inhalation exposures reflect a similar halving of the duration of the golf round from 5 hours to 2.5 hours spent on the impacted half of the golf course. The adjusted fraction of contaminated soil was not used for the teenage trespasser (defined as spending time on the golf course lake in the southern half of the site) and for an alternate construction worker receptor involved in construction activity on the southern half of the golf course only;
- The alternate maintenance worker receptor is similarly exposed to the southern half of the golf course (half the workday); however, daily maintenance activities where soil exposure might occur

(trenching for water line replacement/repair and/or sprinkler repair) were set at 5% of the day versus activities that do not involve soil exposure (lawn mowing, landscape maintenance, etc.) based on discussions with the former golf course operations manager on the percentage of time spent on direct soil exposure activities as noted in the November 18, 2011 Soil Management Plan;

- Soil ingestion rates were modified to reflect the EPA recommended values of 100 milligrams per day (mg/day)(adult golfer) and 200 mg/day (child golfer and teenage trespasser). However, these receptors spend limited time at the golf course each day, so the recommended daily rate values were adjusted as follows:
    - Adult and child golfers are only at the golf course for 5 hours per day, so the ingestion rate was pro-rated using 5 hours out of 18 waking hours per day;
    - Teenage trespasser is only at the golf course for 4 hours per day, so the ingestion rate was pro-rated using 4 hours out of 18 waking hours per day.
- Exposure frequency for the adult and child golfers and teenage trespasser receptors was determined to be less than the longer term frequency (250 days) applied to site workers who would be at the golf course more consistently. Specifically, the details for each of these non-worker receptors are provided as follows:
    - Adult and child golfers – 2 days per week for 50 weeks per year for a total of 100 rounds of golf per year reflects an avid golfing receptor over the 30 year and 8 year exposure durations for each receptor, respectively.
    - Teenage trespasser – 2 days per week for 20 weeks during the spring/summer months over a 4 year period from ages 14 to 17. The basis of this scenario is a receptor illegally entering the golf course, during the middle of the night when the golf course is closed, to spend time at the golf course lake without being noticed by the residences immediately adjacent to the west and east of the golf course/golf course lake. A limited exposure frequency reflecting time periods when a teenage receptor has additional free time (spring/summer breaks) and during warmer months when outdoor activity near a lake would be expected, is an appropriate approach to this receptor.
- Exposure time for the maintenance worker was adjusted to 0.4 hours per 8-hour workday to reflect activities that involve soil exposure (trenching for water line replacement/repair and/or sprinkler repair) versus activities that do not involve soil exposure (lawn mowing, landscape maintenance, etc.) based on discussions with the former golf course operations manager on the percentage of time spent on direct soil exposure activities (5 percent) as noted in the November 18, 2011 Soil Management Plan.

Toxicity factors for Aroclor 1254 were selected from the California Office of Environmental Health Hazard Assessment (OEHHA) toxicity criteria database (OEHHA, 2011). If a toxicity factor was not available, then the USEPA (USEPA, 2011) values were selected. In addition, the Aroclor 1254 ingestion reference dose was used to route-extrapolate a surrogate for an inhalation reference dose, as there are no agency-published toxicity factors for non-cancer effects from inhalation exposure (DTSC, 2011b).

Noncancer hazard and cancer risk estimates were calculated in accordance with USEPA guidance (USEPA, 1989) using an assumed soil concentration of 1 mg/kg of Aroclor 1254. The attached tables provide exposure

parameters, exposure route results, and combined noncancer hazard and cancer risk estimates for use in calculating a screening value that meets the agency-accepted de minimis noncancer hazard threshold of 1.0 and the cancer risk threshold of 1×10^{-6}.

The following text provides explains the process used to calculate screening values using the alternate construction worker receptor as an example. As summarized on Attachment G Tables G1-4 and G1-8, the total noncancer hazard estimate for construction workers from ingestion, dermal, and inhalation exposure was 0.50 (the sum of the dimensionless ratios of exposure to toxicity value for each route) and the cancer risk estimate from ingestion, dermal, and inhalation exposures was 2.9×10^{-7} (the sum of the route-specific dimensionless incremental probabilities of developing cancer). Mathematically scaling the soil exposure concentration to meet these target thresholds produces a concentration of 2.0 mg/kg Aroclor 1254 that is health-protective for noncancer effects, and a concentration of 3.5 mg/kg Aroclor 1254 that is health-protective for cancer effects for the construction worker who only works on the southern part of the Site.

Summary

The final calculated screening values for the receptors along with the defined exposure unit where the screening values apply are summarized in the following table. These screening values would be compared to statistical averages of the data within each exposure unit or appropriately sized sub-portions of each exposure unit (i.e., individual parcels in a residential area) for decision analysis purposes.

Site Specific Risk-Based Soil Screening Criteria for Comparison to Statistically Averaged Site Data
Birch Hills Golf Course, Brea, California
April 2012

Analytes	RSL		Site-Specific Risk-Based						
	Residential (mg/kg)	Commercial (mg/kg)	Construction Worker (primary) (mg/kg)	Construction Worker (Alternate) (mg/kg)	Maintenance Worker (primary) (mg/kg)	Maintenance Worker (alternate) (mg/kg)	Adult Golfer (mg/kg)	Child Golfer (mg/kg)	Teenager Trespasser (mg/kg)
Exposure Unit	Planning Areas 12A and 12B	Existing Golf Course Clubhose/ Potential Community Center	Entire Site	Southern Area Only	Entire Site	Southern Area Only	Entire Site - Playing 18 Holes	Entire Site - Playing 18 Holes	Southern Area Only
PCBs (Aroclor 1254 and Aroclor 1260)	0.220	0.740	4.0	2.0	40	20	6.1	7.1	19
Notes:									
RSL = EPA Region IX Regional Screening Levels, June 2011 version									
Risk-based = Site-specific values (Appendix G). Value presented is the lower of the carcinogenic or noncarinogenic values.									
Exposure Unit based on current golf course development plans and will be subject to change based on changes in future land use									

References

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

DTSC. 2011b. Screening Level Human Health Risk Assessments. Human Health Risk Assessment (HHRA) Note Number 4. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: June 9, 2011.

Maldonado, M, 2011. Golf Course Maintenance Worker Tasks/Time with estimate that maintenance workers spend 5 percent of their time on Sprinkler Repair/Replacement with trenches or potholes. Email communication from Mark Maldonado, former Field Operations Manager for Brea Golf Course, to Jerome Zimmerle, URS Corporation. July 6, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database, July 21, 2009. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://www.oehha.ca.gov/risk/pdf/tcdb072109cas.pdf http://www.oehha.ca.gov/risk/ChemicalDB/index.asp

USEPA, 1989. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*, Interim Final. Office of Emergency and Remedial Response, EPA/540/1-89/002. December.

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2009. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), Final.* EPA-540-R-070-002, OSWER 9285.7-82. Office of Superfund Remediation and Technology Innovation, Environmental Protection Agency, Washington, D.C. January.

USEPA, 2011a. *Integrated Risk Information System (IRIS) Database.* National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database search: http://www.epa.gov/iris (last accessed: 4/26/2012).

USEPA, 2011b. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F.

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables: United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

APPENDIX G TABLES

EXPOSURE FACTOR AND TOXICITY VALUES

Table G-1
Exposure and Toxicity Parameter Values
Construction Workers (alternate)
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Parameter	Variable Name	Value	Units	Source
Exposure Estimation				
Adherence Factor	AF	0.8	mg/cm^2	DTSC (2011a)
Adult Body Weight	BW	70	kg	DTSC (2011a)
Averaging Time for carcinogens	AT_c	25550	days	DTSC (2011a)
Averaging Time for noncarcinogens	AT_{nc}	365	days	DTSC (2011a)
Conversion Factor	CF	1E-06	kg/mg	necessary unit-conversion factor
Dermal Absorption Factor from Soil	ABS	0.15	dimensionless	DTSC (1994)
Exposure Duration	ED	1	year	DTSC (2011a)
Exposure Frequency	EF	250	days/year	DTSC (2011a), USEPA (2012)
Exposure Time	ET	8	hours/day	assumed 8-hour workday
Exposure-Point Concentration of Particulates in Air	EPC_{air}	$=EPC_{soil} \times PEF \times 1000$ (µg/mg)	$\mu g/m^3$	derived concentration for air particulate
Exposure-Point Concentration in Soil	EPC_{soil}	1	mg/kg	assumed starting ("seed") value
Ingestion Rate of Soil	IR_{soil}	330	mg/day	DTSC (2011a)
Particulate Emission Factor	PEF	1.36E+09	kg/m^3	USEPA (2012)
Skin Surface Area	SA	5700	cm^2	DTSC (2011a)
Fraction of Site with Contaminated Soil	FS	1	dimensionless	site-specific conditions: all activity in South Area
Toxicity Factors				
Dermal Reference Dose (noncancer effects)	RfD_D	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a); no adjustment for oral absorption (as per USEPA, 2004)
Dermal Slope Factor (cancer effects)	SF_D	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs: OEHHA (2011) and USEPA (2011a) no adjustment for oral absorption (as per USEPA, 2004)
Inhalation Reference Concentration (noncancer effects)	RfC	7.0E-02	$\mu g/m^3$	Route extrapolation from RfDo, as per USEPA comment
Inhalation Unit Risk (cancer effects)	IUR	5.7E-04	$(\mu g/m^3)^{-1}$	Total PCBs; OEHHA (2011)
Oral Reference Dose (noncancer effects)	RfD_O	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a)
Oral Slope Factor (cancer effects)	SF_O	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs; OEHHA (2011)

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database, July 21, 2009. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://www.oehha.ca.gov/risk/ChemicalDB/index.asp

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2011a. Integrated Risk Information System (IRIS) Database. National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database search: http://www.epa.gov/iris (last accessed: 4/16/2012).

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables:
United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Table G-2
Exposure and Toxicity Parameter Values
Golf Course Maintenance Workers (alternate)
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Parameter	Variable Name	Value	Units	Source
Exposure Estimation				
Adherence Factor	AF	0.2	mg/cm^2	USEPA (2012)
Adult Body Weight	BW	70	kg	DTSC (2011a)
Averaging Time for carcinogens	AT_c	25550	days	DTSC (2011a)
Averaging Time for noncarcinogens	AT_{nc}	9125	days	DTSC (2011a)
Conversion Factor	CF	1E-06	kg/mg	necessary unit-conversion factor
Dermal Absorption Factor from Soil	ABS	0.15	dimensionless	DTSC (1994)
Exposure Duration	ED	25	year	DTSC (2011a)
Exposure Frequency	EF	250	days/year	DTSC (2011a), USEPA (2012)
Exposure Time	ET	0.4	hours/day	site-specific conditions: 5% of daily activity is direct work with soil, 1/2 in South Area, 1/2 in North Area (inhalation exposure)
Exposure-Point Concentration of Particulates in Air	EPC_{air}	$=EPC_{soil} \times PEF \times 1000$ (µg/mg)	$µg/m^3$	derived concentration for air particulate
Exposure-Point Concentration in Soil	EPC_{soil}	1	mg/kg	assumed starting ("seed") value
Ingestion Rate of Soil	IR_{soil}	100	mg/day	DTSC (2011a)
Particulate Emission Factor	PEF	1.36E+09	kg/m^3	USEPA (2012)
Skin Surface Area	SA	5700	cm^2	DTSC (2011a)
Fraction of Site with Contaminated Soil	FS	0.025	dimensionless	site-specific conditions: 5% of daily activity is direct work with soil, 1/2 in South Area, 1/2 in North Area (ingestion and dermal exposures)
Toxicity Factors				
Dermal Reference Dose (noncancer effects)	RfD_D	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a); no adjustment for oral absorption (as per USEPA, 2004)
Dermal Slope Factor (cancer effects)	SF_D	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs: OEHHA (2011) and USEPA (2011a) no adjustment for oral absorption (as per USEPA, 2004)
Inhalation Reference Concentration (noncancer effects)	RfC	7.0E-02	$µg/m^3$	Route extrapolation from RfDo, as per USEPA comment
Inhalation Unit Risk (cancer effects)	IUR	5.7E-04	$(µg/m^3)^{-1}$	Total PCBs; OEHHA (2011)
Oral Reference Dose (noncancer effects)	RfD_O	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a)
Oral Slope Factor (cancer effects)	SF_O	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs; OEHHA (2011)

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database, July 21, 2009. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://www.oehha.ca.gov/risk/ChemicalDB/index.asp

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2011a. Integrated Risk Information System (IRIS) Database. National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database search: http://www.epa.gov/iris (last accessed: 4/16/2012).

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables:
United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Table G-3
Exposure and Toxicity Parameter Values
Golf Course Recreational Users -- Adult
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Parameter	Variable Name	Value	Units	Source
Exposure Estimation				
Adherence Factor	AF	0.08	mg/cm^2	USEPA (2004) Exhibit 3-3: Adult Soccer Player
Adult Body Weight	BW	70	kg	DTSC (2011a) and USEPA (2012)
Averaging Time for carcinogens	AT_c	25550	days	DTSC (2011a)
Averaging Time for noncarcinogens	AT_{nc}	10950	days	DTSC (2011a)
Conversion Factor	CF	1E-06	kg/mg	necessary unit-conversion factor
Dermal Absorption Factor from Soil	ABS	0.15	dimensionless	DTSC (1994)
Exposure Duration	ED	30	year	assumed
Exposure Frequency	EF	100	days/year	twice per week, 50 weeks
Exposure Time	ET	2.5	hours/day	site-specific conditions: 5-hour golf round (inhalation exposure), 1/2 activity in South Area, 1/2 activity in North Area
Exposure-Point Concentration of Particulate in Air	EPC_{air}	$=EPC_{soil} \times PEF \times 1000$ (µg/mg)	$\mu g/m^3$	derived concentration for air particulate
Exposure-Point Concentration in Soil	EPC_{soil}	1	mg/kg	assumed starting ("seed") value
Ingestion Rate of Soil	IR_{soil}	30	mg/day	proportion of total daily ingestion (100 mg/day; DTSC, 2011a) attributable to time on the golf course (5 hrs/day out of 18 hrs awake)
Particulate Emission Factor	PEF	1.36E+09	kg/m^3	USEPA (2012)
Skin Surface Area	SA	5700	cm^2	DTSC (2011a)
Fraction of Site with Contaminated Soil	FS	0.5	dimensionless	site-specific conditions: 1/2 activity in South Area, 1/2 activity in North Area (ingestion and dermal exposures)
Toxicity Factors				
Dermal Reference Dose (noncancer effects)	RfD_D	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a); no adjustment for oral absorption (as per USEPA, 2004)
Dermal Slope Factor (cancer effects)	SF_D	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs: OEHHA (2011) and USEPA (2011a) no adjustment for oral absorption (as per USEPA, 2004)
Inhalation Reference Concentration (noncancer effects)	RfC	7.0E-02	$\mu g/m^3$	Route extrapolation from RfDo, as per USEPA comment
Inhalation Unit Risk (cancer effects)	IUR	5.7E-04	$(\mu g/m^3)^{-1}$	Total PCBs; OEHHA (2011)
Oral Reference Dose (noncancer effects)	RfD_O	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a)
Oral Slope Factor (cancer effects)	SF_O	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs; OEHHA (2011)

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://oehha.ca.gov/tcdb/index.asp

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2011a. Integrated Risk Information System (IRIS) Database. National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database search: http://www.epa.gov/iris (last accessed: 4/16/2012).

USEPA, 2011b. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F.

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables:
United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Table G-4
Exposure and Toxicity Parameter Values
Golf Course Recreational Users -- Child
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Parameter	Variable Name	Value	Units	Source
Exposure Estimation				
Adherence Factor	AF	0.3	mg/cm^2	USEPA (2004) Exhibit 3-3: Teen Soccer Player (moist conditions)
Adult Body Weight	BW	70	kg	DTSC (2011) and USEPA (2012)
Averaging Time for carcinogens	AT_c	25550	days	DTSC (2011)
Averaging Time for noncarcinogens	AT_{nc}	2920	days	DTSC (2011)
Conversion Factor	CF	1E-06	kg/mg	necessary unit-conversion factor
Dermal Absorption Factor from Soil	ABS	0.15	dimensionless	DTSC (1994)
Exposure Duration	ED	8	year	assumed (age 10 to 17)
Exposure Frequency	EF	100	days/year	twice per week, 50 weeks
Exposure Time	ET	2.5	hours/day	site-specific conditions: 5-hour golf round (inhalation exposure), 1/2 activity in South Area, 1/2 activity in North Area
Exposure-Point Concentration of Particulate in Air	EPC_{air}	$=EPC_{soil} \times PEF \times 1000$ (µg/mg)	$\mu g/m^3$	derived concentration for air particulate
Exposure-Point Concentration in Soil	EPC_{soil}	1	mg/kg	assumed starting ("seed") value
Ingestion Rate of Soil	IR_{soil}	60	mg/day	proportion of total daily ingestion (200 mg/day, DTSC, 2011) attributable to time on the golf course (5 hrs/day out of 18 hrs awake)
Particulate Emission Factor	PEF	1.36E+09	kg/m^3	USEPA (2012)
Skin Surface Area	SA	5700	cm^2	DTSC (2011)
Fraction of Site with Contaminated Soil	FS	0.5	dimensionless	site-specific conditions: 1/2 activity in South Area, 1/2 activity in North Area (ingestion and dermal exposures)
Toxicity Factors				
Dermal Reference Dose (noncancer effects)	RfD_D	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a); no adjustment for oral absorption (as per USEPA, 2004)
Dermal Slope Factor (cancer effects)	SF_D	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs: OEHHA (2011) and USEPA (2011a) no adjustment for oral absorption (as per USEPA, 2004)
Inhalation Reference Concentration (noncancer effects)	RfC	7.0E-02	$\mu g/m^3$	Route extrapolation from RfDo, as per USEPA comment
Inhalation Unit Risk (cancer effects)	IUR	5.7E-04	$(\mu g/m^3)^{-1}$	Total PCBs; OEHHA (2011)
Oral Reference Dose (noncancer effects)	RfD_O	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a)
Oral Slope Factor (cancer effects)	SF_O	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs; OEHHA (2011)

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://oehha.ca.gov/tcdb/index.asp

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2011a. Integrated Risk Information System (IRIS) Database. National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database search: http://www.epa.gov/iris (last accessed: 4/16/2012).

USEPA, 2011b. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F.

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables:
United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Table G-5
Exposure and Toxicity Parameter Values
Golf Course Trespassers -- Teenage
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Parameter	Variable Name	Value	Units	Source
Exposure Estimation				
Adherence Factor	AF	0.3	mg/cm^2	USEPA (2004) Exhibit 3-3: Teen Soccer Player (moist conditions)
Adult Body Weight	BW	70	kg	DTSC (2011) and USEPA (2012)
Averaging Time for carcinogens	AT_c	25550	days	DTSC (2011)
Averaging Time for noncarcinogens	AT_{nc}	1460	days	DTSC (2011)
Conversion Factor	CF	1E-06	kg/mg	necessary unit-conversion factor
Dermal Absorption Factor from Soil	ABS	0.15	dimensionless	DTSC (1994)
Exposure Duration	ED	4	year	assumed (Freshman--Senior years, age 14 to 17)
Exposure Frequency	EF	40	days/year	twice per week, 20 weeks (May-September)
Exposure Time	ET	4	hours/day	assumed time at course lake
Exposure-Point Concentration of Particulate in Air	EPC_{air}	$=EPC_{soil} \times PEF \times 1000$ (µg/mg)	$µg/m^3$	derived concentration for air particulate
Exposure-Point Concentration in Soil	EPC_{soil}	1	mg/kg	assumed starting ("seed") value
Ingestion Rate of Soil	IR_{soil}	45	mg/day	proportion of total daily ingestion (200 mg/day, DTSC, 2011) attributable to time at course lake (4 hrs/day out of 18 hrs awake)
Particulate Emission Factor	PEF	1.36E+09	kg/m^3	USEPA (2012)
Skin Surface Area	SA	5700	cm^2	DTSC (2011)
Fraction of Site with Contaminated Soil	FS	1	dimensionless	site-specific conditions: all activity in South Area
Toxicity Factors				
Dermal Reference Dose (noncancer effects)	RfD_D	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a); no adjustment for oral absorption (as per USEPA, 2004)
Dermal Slope Factor (cancer effects)	SF_D	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs: OEHHA (2011) and USEPA (2011a) no adjustment for oral absorption (as per USEPA, 2004)
Inhalation Reference Concentration (noncancer effects)	RfC	7.0E-02	$µg/m^3$	Route extrapolation from RfDo, as per USEPA comment
Inhalation Unit Risk (cancer effects)	IUR	5.7E-04	$(µg/m^3)^{-1}$	Total PCBs; OEHHA (2011)
Oral Reference Dose (noncancer effects)	RfD_O	2.0E-05	mg/kg-day	Aroclor 1254; USEPA (2011a)
Oral Slope Factor (cancer effects)	SF_O	2.0E+00	$(mg/kg\text{-}day)^{-1}$	Total PCBs; OEHHA (2011)

DTSC, 1994 (Second Printing: 1999). Preliminary Endangerment Assessment Guidance Manual. State of California; Environmental Protection Agency, Department of Toxic Substances Control. January.

DTSC, 2011a. Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. Human Health Risk Assessment (HHRA) Note Number 1. California Department of Toxic Substances Control (DTSC), Office of Human and Ecological Risk (HERO). Issue Date: May 20, 2011.

OEHHA, 2011. OEHHA Toxicity Criteria Database. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. (last accessed: 4/16/2012) http://oehha.ca.gov/tcdb/index.asp

USEPA, 2004. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Assessment); Final. EPA/540/R/99/005, OSWER 9285.7-02 EP, PB99-963312. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency, Washington, D.C. July.

USEPA, 2011a. Integrated Risk Information System (IRIS) Database. National Center for Environmental Assessment, United States Environmental Protection Agency, Washington, D.C. Online database

USEPA, 2011b. Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F.

USEPA, 2012: Default exposure factors incorporated into the USEPA Regional Screening Level Tables:
United States Environmental Protection Agency Regions 3, 6, and 9. (last accessed 4/16/2012). Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

ATTACHMENT G

RISK AND HAZARD ESTIMATES

AND RBSL DERIVATIONS

Attachment G1

Construction Worker (alternate) Receptor

Table G1-1
Noncancer Hazard from Ingestion of Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Reference Dose (RfD_o) (mg/kg-d)	Construction Worker Scenario	
			Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E-05	3.2E-06	1.6E-01

Notes:
"--" not available

Equations:

Worker Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * $AT_{noncancer}$))

Worker Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

ATnc = Averaging Time for noncarcinogens (1 year * 365 days/year = 365 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

IR-S=Ingestion Rate of Soil (330 mg/day)

Table G1-2
Noncancer Hazard from Dermal Contact with Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Reference Dose (RfD_o) (mg/kg-d)	Construction Worker Scenario	
				Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E-05	6.7E-06	3.3E-01

Notes:

"--" not available

Equations:

Worker Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * $AT_{noncancer}$))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

AF = Adherence Factor (0.8 mg/cm^2)

ATnc = Averaging Time for noncarcinogens (1 year * 365 days/year = 365 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G1-3
Noncancer Hazard from Inhalation of Outdoor Particulates from Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Reference Concentration (RfC_i) ($\mu g/m^3$)	Commercial Worker Scenario	
					Average Concentration Adult ($\mu g/m^3$)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.00E+00	1.00E+06	1.0E-03	7.0E-02	2.3E-04	3.3E-03

Notes:

"--" not available

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Average Concentration (noncarcinogens) = EPC_{air} * [(ED * EF * ET)/(ATnc * 24 hr/d)]

Hazard Quotient = Average Concentration (noncarcinogens) / RfC_i

Definition:

ATnc = Averaging Time for noncarcinogens (1 year * 365 days/year =365 days)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

ET = Exposure Time (8 hours / day)

Table G1-4
Summary of Noncancer Hazards and "Risk-Based" Screening Levels for Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Construction Worker Scenario, Hazard Estimates				RBSL (mg/kg)
	Adult				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total HI	
Aroclor 1254	1.6E-01	3.3E-01	3.3E-03	5.0E-01	2.0E+00

Notes:
"–" not calculated
RBSK = "Risk" [noncancer hazard] -Based Screening Level
RBSL = 1 mg/kg [assumed exposure concentration]) / Total HI [dimensionless] × Target Hazard [=1.0 (dimensionless)]

Table G1-5
Cancer Risk from Ingestion of Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Construction Worker Scenario	
			Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E+00	4.6E-08	9.2E-08

Notes:

"--" not available or not detected

Equations:

Worker Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_{cancer}))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

IR-S=Ingestion Rate of Soil (330 mg/day)

Table G1-6
Cancer Risk from Dermal Contact with Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Construction Worker Scenario	
				Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E+00	9.6E-08	1.9E-07

Notes:

"–" not available or not detected

Equations:

Worker Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * AT_{cancer}))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

AF = Adherence Factor (0.8 mg/cm^2)

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G1-7
Cancer Risk from Inhalation of Outdoor Particulates from Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Construction Worker Scenario	
					Lifetime Average Concentration Adult (ug/m^3)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.00E+06	1.0E-03	5.7E-04	3.3E-06	1.9E-09

Notes:

"--" not available or not detected

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Lifetime Average Concentration (carcinogens) = (EPC_{air} * [(ED * EF * ET)/(ATc * 24 hr/d)]

Cancer Risk = Lifetime Average Concentration (carcinogens) * IUR

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

ED = Exposure Duration (1 year)

EF = Exposure Frequency (250 days / year)

ET = Exposure Time (8 hours / day)

Table G1-8
Summary of Cancer Risks and Risk-Based Screening Levels for Soil
Construction Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Construction Worker Scenario, Hazard Estimates Adult				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total Cancer Risk	Cancer RBSL (mg/kg)
Aroclor 1254	9.2E-08	1.9E-07	1.9E-09	2.9E-07	3.50E+00

Notes:
"–" not calculated
RBSL = Risk-Based Screening Level
RBSL = (1 mg/kg [assumed exposure concentration] / Cancer Risk [dimensionless]) × Target Risk (=1×10^{-6} [dimensionless])

Attachment G2

Maintenance Worker (alternate) Receptor

Table G2-1
Noncancer Hazard from Ingestion of Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Reference Dose (RfD_o) (mg/kg-d)	Maintenance Worker Scenario	
			Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E-05	2.4E-08	1.2E-03

Equations:

Worker Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * $AT_{noncancer}$))

Worker Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

ATnc = Averaging Time for noncarcinogens (25 years * 365 days/year = 9125 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (0.1 unitless)

IR-S=Ingestion Rate of Soil (330 mg/day)

Table G2-2
Noncancer Hazard from Dermal Contact with Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Reference Dose (RfD_o) (mg/kg-d)	Maintenance Worker Scenario	
				Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E-05	4.2E-08	2.1E-03

Equations:

Worker Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * $AT_{noncancer}$))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

AF = Adherence Factor (0.2 mg/cm^2)

ATnc = Averaging Time for noncarcinogens (25 years * 365 days/year = 9125 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (0.1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G2-3
Noncancer Hazard from Inhalation of Outdoor Particulates from Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) (µg/m^3)	Inhalation Reference Concentration (RfC_i) (µg/m^3)	Maintenance Worker Scenario	
					Average Concentration Adult (µg/m^3)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.00E+00	1.00E+06	1.0E-03	7.0E-02	1.1E-05	1.6E-04

Notes:

"--" not available

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Average Concentration (noncarcinogens) = EPC_{air} * [(ED * EF * ET)/(ATnc * 24 hr/d)]

Hazard Quotient = Average Concentration (noncarcinogens) / RfC_i

Definition:

ATnc = Averaging Time for noncarcinogens (25 years * 365 days/year = 9125 days)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

ET = Exposure Time (4 hours / day)

Table G2-4
Summary of Noncancer Risk-Based Screening Levels for Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Maintenance Worker Scenario				
	Adult				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total HI	Noncancer RBSL (mg/kg)
Aroclor 1254	1.2E-03	2.1E-03	1.6E-04	3.5E-03	2.9E+02

Notes:
"--" not calculated
RBSL = "Risk"-Based Screening Level [noncancer hazard]
RBSL = 1 mg/kg [assumed exposure concentration]) / Total HI [dimensionless] × Target Hazard [=1.0 (dimensionless)]

Table G2-5
Cancer Risk from Ingestion of Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Maintenance Worker Scenario	
			Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E+00	8.7E-09	1.7E-08

Equations:

Worker Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_{cancer}))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (0.1 unitless)

IR-S=Ingestion Rate of Soil (330 mg/day)

Table G2-6
Cancer Risk from Dermal Contact with Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Maintenance Worker Scenario	
				Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E+00	1.5E-08	3.0E-08

Equations:

Worker Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * AT_{cancer}))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

AF = Adherence Factor (0.2 mg/cm^2)

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

FS = Fraction of Site with Contaminated Soil (0.1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G2-7
Cancer Risk from Inhalation of Outdoor Particulates from Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Maintenance Worker Scenario	
					Lifetime Average Concentration Adult (ug/m^3)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.00E+06	1.0E-03	5.7E-04	4.1E-06	2.3E-09

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Lifetime Average Concentration (carcinogens) = (EPC_{air} * [(ED * EF * ET)/(ATc * 24 hr/d)]

Cancer Risk = Lifetime Average Concentration (carcinogens) * IUR

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

ED = Exposure Duration (25 years)

EF = Exposure Frequency (250 days / year)

ET = Exposure Time (4 hours / day)

Table G2-8
Summary of Cancer Risk-Based Screening Levels for Soil
Maintenance Workers (alternate)
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Conern	Maintenance Worker Scenario, Risk Estimates Adult Workers				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total Cancer Risk	Cancer RBSL (mg/kg)
Aroclor 1254	1.7E-08	3.0E-08	2.3E-09	5.0E-08	2.0E+01

RBSL = Risk-Based Screening Level

RBSL = (1 mg/kg [assumed exposure concentration] / Cancer Risk [dimensionless]) × Target Risk (=1×10^{-6} [dimensionless])

Attachment G3

Adult Golfer Receptor

Table G3-1
Noncancer Hazard from Ingestion of Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Reference Dose (RfD_o) (mg/kg-d)	Adult Golfer Scenario	
			Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E-05	5.9E-08	2.9E-03

Equations:

Adult Golfer Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

ATnc = Averaging Time for noncarcinogens (30 year * 365 days/year = 10,950 days)

BW = Body Weight (70 kg)

CF = Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

IR-S = Ingestion Rate of Soil (300 mg/day)

Table G3-2
Noncancer Hazard from Dermal Contact with Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Reference Dose (RfD_o) (mg/kg-d)	Adult Golfer Scenario	
				Average Daily Intake Adult (mg/kg-d)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E-05	1.3E-07	6.7E-03

Equations:

Adult Golfer Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

AF = Adherence Factor (0.08 mg/cm^2)

ATnc = Averaging Time for noncarcinogens (30 year * 365 days/year = 10,950 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G3-3
Noncancer Hazard from Inhalation of Outdoor Particulates from Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Reference Concentration (RfC_i) ($\mu g/m^3$)	Adult Golfer Scenario	
					Average Concentration Adult ($\mu g/m^3$)	Hazard Quotient Adult (Unitless)
Aroclor 1254	1.00E+00	1.36E+09	7.4E-07	7.0E-02	1.0E-08	1.5E-07

Notes:

"--" not available

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Average Concentration (noncarcinogens) = EPC_{air} * [(ED * EF * ET * FS)/(ATnc * 24 hr/d)]

Hazard Quotient = Average Concentration (noncarcinogens) / RfC_i

Definition:

ATnc = Averaging Time for noncarcinogens (30 year * 365 days/year = 10,950 days)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

ET = Exposure Time (2.5 hours / day)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

Table G3-4
Summary of Noncancer Risk-Based Screening Levels for Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Adult Golfer Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total HI	Noncancer RBSL (mg/kg)
Aroclor 1254	2.9E-03	6.7E-03	1.5E-07	9.6E-03	1.0E+02

Notes:
"--" not calculated
RBSL = "Risk"-Based Screening Level [noncancer hazard]
RBSL = 1 mg/kg [assumed exposure concentration]) / Total HI [dimensionless] × Target Hazard [=1.0 (dimensionless)]

Table G3-5
Cancer Risk from Ingestion of Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Adult Golfer Scenario	
			Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	2.0E+00	2.5E-08	5.0E-08

Equations:

Adult Golfer Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_c))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

IR-S = Ingestion Rate of Soil (30 mg/day)

Table G3-6
Cancer Risk from Dermal Contact with Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Adult Golfer Scenario	
				Average Daily Intake Adult (mg/kg-d)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E+00	5.7E-08	1.1E-07

Equations:

Adult Golfer Average Daily $INTAKE_{cancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_c))

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

AF = Adherence Factor (0.08 mg/cm^2)

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G3-7
Cancer Risk from Inhalation of Outdoor Particulates from Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) (µg/m^3)	Inhalation Unit Risk (IUR) (ug/m^3)$^{-1}$	Adult Golfer Scenario	
					Lifetime Average Concentration Adult (ug/m^3)	Cancer Risk Adult (Unitless)
Aroclor 1254	1.0E+00	1.36E+09	7.4E-07	5.7E-04	3.6E-09	2.1E-12

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Lifetime Average Concentration (carcinogens) = (EPC_{air} * [(ED * EF * ET * FS)/(ATc * 24 hr/d)]

Cancer Risk = Lifetime Average Concentration (carcinogens) * IUR

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

ED = Exposure Duration (30 years)

EF = Exposure Frequency (100 days / year)

ET = Exposure Time (2.5 hours / day)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

Table G3-8
Summary of Cancer Risk-Based Screening Levels for Soil
Adult Golfer
Development Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Conern	Adult Golfer Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total Cancer Risk	Cancer RBSL (mg/kg)
Aroclor 1254	5.0E-08	1.1E-07	2.1E-12	1.7E-07	6.1E+00

RBSL = Risk-Based Screening Level

RBSL = (1 mg/kg [assumed exposure concentration] / Cancer Risk [dimensionless]) × Target Risk (=1×10^{-6} [dimensionless])

Attachment G4

Child Golfer Receptor

Table G4-1
Noncancer Hazard from Ingestion of Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Reference Dose (RfD_o) (mg/kg-d)	Child Golfer Scenario	
			Average Daily Intake Child (mg/kg-d)	Hazard Quotient Child (Unitless)
Aroclor 1254	1.0E+00	2.0E-05	1.2E-07	5.9E-03

Equations:

Child Golfer Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

ATnc = Averaging Time for noncarcinogens (8 year * 365 days/year = 2,920 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

IR-S=Ingestion Rate of Soil (60 mg/day)

Table G4-2
Noncancer Hazard from Dermal Contact with Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Reference Dose (RfD_o) (mg/kg-d)	Child Golfer Scenario	
				Average Daily Intake Child (mg/kg-d)	Hazard Quotient Child (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E-05	5.0E-07	2.5E-02

Equations:

Child Golfer Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

AF = Adherence Factor (0.3 mg/cm^2)

ATnc = Averaging Time for noncarcinogens (8 year * 365 days/year = 2,920 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G4-3
Noncancer Hazard from Inhalation of Outdoor Particulates from Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Reference Concentration (RfC_i) ($\mu g/m^3$)	Child Golfer Scenario	
					Average Concentration Child ($\mu g/m^3$)	Hazard Quotient Child (Unitless)
Aroclor 1254	1.00E+00	1.36E+09	7.4E-07	7.0E-02	1.0E-08	1.5E-07

Notes:

"--" not available

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Average Concentration (noncarcinogens) = EPC_{air} * [(ED * EF * ET * FS)/(ATnc * 24 hr/d)]

Hazard Quotient = Average Concentration (noncarcinogens) / RfC_i

Definition:

ATnc = Averaging Time for noncarcinogens (8 year * 365 days/year = 2,920 days)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

ET = Exposure Time (2.5 hours / day)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

Table G4-4
Summary of Noncancer Risk-Based Screening Levels for Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Child Golfer Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total HI	Noncancer RBSL (mg/kg)
Aroclor 1254	5.9E-03	2.5E-02	1.5E-07	3.1E-02	3.2E+01

Notes:
"--" not calculated
RBSL = "Risk"-Based Screening Level [noncancer hazard]
RBSL = 1 mg/kg [assumed exposure concentration]) / Total HI [dimensionless] × Target Hazard [=1.0 (dimensionless)]

Table G4-5
Cancer Risk from Ingestion of Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Child Golfer Scenario	
			Average Daily Intake Child (mg/kg-d)	Cancer Risk Child (Unitless)
Aroclor 1254	1.0E+00	2.0E+00	1.3E-08	2.7E-08

Equations:

Child Golfer Average Daily $INTAKE_{cancer}$ (mg/kg-day) =EPC * ([IR-S*EF*ED*FS*CF]/[BW*ATc])

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

IR-S=Ingestion Rate of Soil (60 mg/day)

Table G4-6
Cancer Risk from Dermal Contact with Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Child Golfer Scenario	
				Average Daily Intake Child (mg/kg-d)	Cancer Risk Child (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E+00	5.7E-08	1.1E-07

Equations:

Child Golfer Average Daily $INTAKE_{cancer}$ (mg/kg-day) = EPC*[(SA*AF*ABS*EF*ED*FS*CF)/(BW*ATc)]

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

AF = Adherence Factor (0.3 mg/cm^2)

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G4-7
Cancer Risk from Inhalation of Outdoor Particulates from Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Child Golfer Scenario	
					Lifetime Average Concentration Child (ug/m^3)	Cancer Risk Child (Unitless)
Aroclor 1254	1.0E+00	1.36E+09	7.4E-07	5.7E-04	1.2E-09	6.8E-13

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Lifetime Average Concentration (carcinogens) = EPC_{air} * [(ED * EF * ET * FS)/(ATc * 24 hr/d)]

Cancer Risk = Lifetime Average Concentration (carcinogens) * IUR

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

ED = Exposure Duration (8 years)

EF = Exposure Frequency (100 days / year)

ET = Exposure Time (5 hours / day)

FS = Fraction of Site with Contaminated Soil (0.5 unitless)

Table G4-8
Summary of Cancer Risk-Based Screening Levels for Soil
Child Golfer
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Conern	Child Golfer Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total Cancer Risk	Cancer RBSL (mg/kg)
Aroclor 1254	2.7E-08	1.1E-07	6.8E-13	1.4E-07	7.1E+00

RBSL = Risk-Based Screening Level

RBSL = (1 mg/kg [assumed exposure concentration] / Cancer Risk [dimensionless]) × Target Risk (=1×10^{-6} [dimensionless])

Attachment G5

Teenage Trespasser Receptor

Table G5-1
Noncancer Hazard from Ingestion of Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Reference Dose (RfD_o) (mg/kg-d)	Teen Trespasser Scenario	
			Average Daily Intake Teenager (mg/kg-d)	Hazard Quotient Teenager (Unitless)
Aroclor 1254	1.0E+00	2.0E-05	7.0E-08	3.5E-03

Equations:

Teen Trespasser Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * IR-S * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

ATnc = Averaging Time for noncarcinogens (4 year * 365 days/year = 1,460 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

IR-S=Ingestion Rate of Soil (45 mg/day)

Table G5-2
Noncancer Hazard from Dermal Contact with Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Reference Dose (RfD_o) (mg/kg-d)	Teen Trespasser Scenario	
				Average Daily Intake Teenager (mg/kg-d)	Hazard Quotient Teenager (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E-05	4.0E-07	2.0E-02

Equations:

Teen Trespasser Average Daily $INTAKE_{noncancer}$ (mg/kg-day) = ((EPC * SA * AF * ABS * EF * ED * FS * CF) / (BW * AT_{nc}))

Noncancer Hazard = ($INTAKE_{noncancer}$ / RfD_o)

Definition:

AF = Adherence Factor (0.3 mg/cm^2)

ATnc = Averaging Time for noncarcinogens (4 year * 365 days/year = 1,460 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G5-3
Noncancer Hazard from Inhalation of Outdoor Particulates from Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Reference Concentration (RfC_i) ($\mu g/m^3$)	Teen Trespasser Scenario	
					Average Concentration Teenager ($\mu g/m^3$)	Hazard Quotient Teenager (Unitless)
Aroclor 1254	1.00E+00	1.36E+09	7.4E-07	7.0E-02	1.3E-08	1.9E-07

Notes:

"–" not available

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Average Concentration (noncarcinogens) = EPC_{air} * [(ED * EF * ET * FS)/(ATnc * 24 hr/d)]

Hazard Quotient = Average Concentration (noncarcinogens) / RfC_i

Definition:

ATnc = Averaging Time for noncarcinogens (4 year * 365 days/year = 1,460 days)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

ET = Exposure Time (4 hours / day)

FS = Fraction of Site with Contaminated Soil (1 unitless)

Table G5-4
Summary of Noncancer Risk-Based Screening Levels for Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Teen Trespasser Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total HI	Noncancer RBSL (mg/kg)
Aroclor 1254	3.5E-03	2.0E-02	1.9E-07	2.4E-02	4.2E+01

Notes:
RBSL = "Risk"-Based Screening Level [noncancer hazard]
RBSL = 1 mg/kg [assumed exposure concentration]) / Total HI [dimensionless] × Target Hazard [=1.0 (dimensionless)]

Table G5-5
Cancer Risk from Ingestion of Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Oral Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Teen Trespasser Scenario	
			Average Daily Intake Teenager (mg/kg-d)	Cancer Risk Teenager (Unitless)
Aroclor 1254	1.0E+00	2.0E+00	4.0E-09	8.1E-09

Equations:

Teen Trespasser Average Daily $INTAKE_{cancer}$ (mg/kg-day) = EPC * [(IR-S*EF*ED*FS*CF)/(BW*ATc)]

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

IR-S=Ingestion Rate of Soil (45 mg/day)

Table G5-6
Cancer Risk from Dermal Contact with Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Exposure Point Concentration in Soil (EPC) (mg/kg)	Soil-to-Skin Absorption Factor (ABS) (unitless)	Oral/Dermal Slope Factor (SFO) $(mg/kg\text{-}d)^{-1}$	Teen Trespasser Scenario	
				Average Daily Intake Teenager (mg/kg-d)	Cancer Risk Teenager (Unitless)
Aroclor 1254	1.0E+00	1.50E-01	2.0E+00	2.3E-08	4.6E-08

Equations:

Teen Trespasser Average Daily $INTAKE_{cancer}$ (mg/kg-day) = EPC*[(SA*AF*ABS*EF*ED*FS*CF)/(BW*ATc)]

Cancer Risk = ($INTAKE_{cancer}$ * SFO)

Definition:

AF = Adherence Factor (0.3 mg/cm^2)

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

BW = Body Weight (70 kg)

CF=Conversion Factor (1E-6 kg/mg)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

FS = Fraction of Site with Contaminated Soil (1 unitless)

SA = Skin Surface Area (5700 cm^2/day)

Table G5-7
Cancer Risk from Inhalation of Outdoor Particulates from Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Concern	Source Term Concentration in Soil (STC) (mg/kg)	Particulate Emission Factor (PEF) (m^3/kg)	Exposure Point Concentration in Air (EPC_{air}) ($\mu g/m^3$)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Teen Trespasser Scenario	
					Lifetime Average Concentration Teenager (ug/m^3)	Cancer Risk Teenager (Unitless)
Aroclor 1254	1.0E+00	1.36E+09	7.4E-07	5.7E-04	7.7E-10	4.4E-13

Equations:

EPC_{air} (particulate) = (STC / PEF) × 1000 µg/mg

Lifetime Average Concentration (carcinogens) = EPC_{air} * [(ED * EF * ET * FS)/(ATc * 24 hr/d)]

Cancer Risk = Lifetime Average Concentration (carcinogens) * IUR

Definition:

ATc = Averaging Time for carcinogens (70 years * 365 days/year = 25,550 days)

ED = Exposure Duration (4 years)

EF = Exposure Frequency (40 days / year)

ET = Exposure Time (4 hours / day)

FS = Fraction of Site with Contaminated Soil (1 unitless)

Table G5-8
Summary of Cancer Risk-Based Screening Levels for Soil
Teen Trespasser
Development of Risk-Based Screening Levels for Soil
Birch Hills Golf Course
2250 Birch Hills
Brea, California

Chemical of Potential Conern	Teen Trespasser Scenario				
	Ingestion	Dermal	Outdoor Particulates Inhalation	Total Cancer Risk	Cancer RBSL (mg/kg)
Aroclor 1254	8.1E-09	4.6E-08	4.4E-13	5.4E-08	1.9E+01

RBSL = Risk-Based Screening Level

RBSL = (1 mg/kg [assumed exposure concentration] / Cancer Risk [dimensionless]) × Target Risk (=1×10^{-6} [dimensionless])